THE EFFECT OF THE DURATION OF HYPOXIA ON THE ACTIVITY OF PEROXIDASE, SUPEROXIDE DISMUTASE AND CATALASE IN THE ROOTS OF CLONAL *EUCALYPTUS MARGINATA*.

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INTRODUCTION

Roots of *E. marginata* exposed to hypoxia show increased resistance to infection by *P. cinnamomi* (1). A plant defence enzyme, peroxidase (PO), involved in lignin and suberin synthesis, the clearance of hydrogen peroxide and the cross-linking of cell wall components (2), are known to be stimulated under low oxygen (3). PO activity in the cell wall results in it becoming more resistant to pathogen attack. This study examined the effect of the duration of hypoxia on the activity of PO in *E. marginata* roots.

MATERIALS AND METHODS

Clones of *E. marginata* were grown in aeroponics chambers in which the oxygen levels could be altered. Roots grown under normal oxygen were compared with those that had been exposed to hypoxia (2 mg O_2 l^{-1}) for 2, 5, 11 and 29 days. Roots were harvested and PO activity separated into soluble and ionically bound fractions. Superoxide dismutase (SOD) and catalase activities were measured on the soluble fractions.

RESULTS AND DISCUSSION

At the end of the hypoxic treatments, soluble PO activity was highest in the apical cm of roots exposed to hypoxia for the longest period (Figure 1). IEF gels stained for PO activity indicated both an increase in existing PO and an induction of a new PO.

Restoration of normal oxygen conditions resulted in a rapid decrease in the peroxidase activity (Figure 1). Infection of the root tip by *P. cinnamomi* caused peroxidase levels in all treatments to drop to about 10% of that in non-inoculated roots (Figure 2).

High PO activity during hypoxia does not appear to be related to the low infection levels after hypoxia. Soluble PO could be involved in the acclimation of roots to low oxygen or the scavenging of oxygen radicals, preventing membrane damage upon restoration of normal oxygen conditions (4). To test this hypothesis, other oxygen scavenging enzymes were also measured. Catalase, SOD and PO activity were all higher in the apical cm of roots after 5 or 29 days hypoxia compared with controls (Table 1).

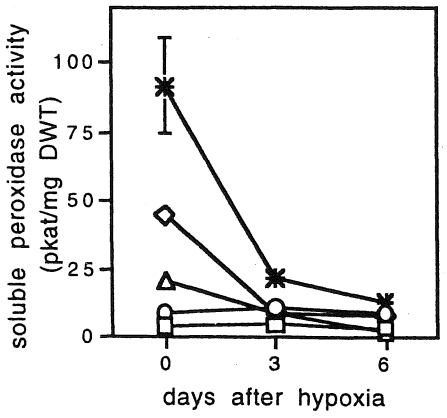

Figure 1. Soluble PO activity in the apical cm of roots in the 6 days after hypoxic treatments of 0 ( ), 2 ( ), 5 ( ), 11 ( ) and 29 ( ) days.

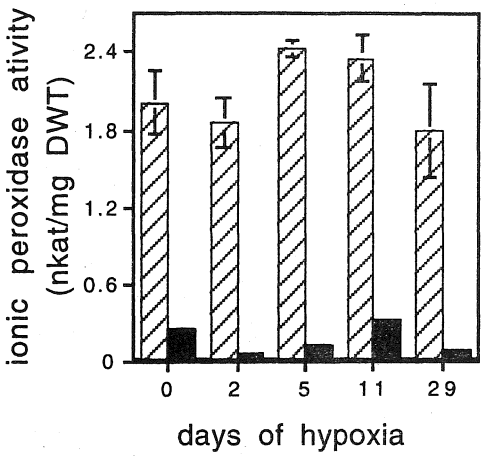

Figure 2. Ionic PO activity in the apical cm of roots 3 days after 0-29 days of hypoxia; non-infected roots ( ) were compared to infected roots ( ) that had been inoculated immediately after 0-29 days of hypoxia

(mg-1 DWT)	days of hypoxia		
	0	5	29
SOD (units s^{-1})	0.038 ±0.006	0.028 ±0.002	10.36 ±0.006
catalase (nmol H_2O_2 s^{-1})	0.09 ±0.036	0.66 ±0.156	0.58 ±0.136
soluble PO (nkat)	0.04 ±0.01	0.21 ±0.08	0.92 ±0.17

Table 1. PO, SOD and catalase activity in the apical cm of roots exposed to 0, 5 and 29 days of hypoxia.

Thus, the accumulation of soluble peroxidase, SOD and catalase in root tips during hypoxia may result from an hypoxia-induced alteration in gene expression producing oxidative enzymes that would prevent membrane damage when the roots return to normal oxygen.

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